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Education and Productivity:
Some New Evidence and Implications for Chile

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Abstract

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Education and Productivity: Some New Evidence and Implications for Chile

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1
1. Introduction

Most of the surge of Chile’s economic growth in the golden period that goes from the mid 1980s to the late 1990s is related to increases in TFP growth (Gallego and Loayza, 2002; De Gregorio, 2005; Fuentes et al., 2006). Since then there is a decrease in economic growth that consistently with the previous evidence seems to be closely related to a decrease in TFP growth (Bitrán y González, 2010). So the question is what may be driving this decrease in TFP growth in the last decade. There are several hypotheses but actually in a sense the decrease in growth rates over the 2000s was not unexpected in an scenario with (i) no significant structural reforms over the 2000s and (ii) the presence of conditional convergence in growth rates, as at least two papers forecasted in the late 1990s (Barro, 1999 and Gallego and Loayza, 2002).

In this paper we focus on one particular dimension that may have affected the growth rates: human capital. From a conceptual point of view, human capital levels can be decomposed in terms of quantity and quality. Figures 1 and 2 present the relationship between proxies for both dimensions and per-capita income across countries. Data suggest that while Chile presents a quantity of human capital (proxied by average years of schooling) consistent with its per-capita income, the quality of human capital (proxied by scores in internationally comparable tests) is below what is expected given its economic development.1 Thus, in this paper we first estimate the potential impact of this relatively low level of human capital quality on economic growth, distinguishing between capital accumulation and TFP growth2

We base our approach in the empirical literature that suggests the existence of positive causal effects of human capital quality on economic growth (Barro, 2001; Hanushek and Kimko, 2000; Hanushek and Woessmann, 2008, 2009). These papers are relatively silent in terms of evidence on the mechanisms (i.e., factor accumulation versus productivity growth) that explain the effect of human capital quality on growth, with the exception of the paper by Jamison et al. (2007) that presents evidence suggesting that the effects are related to TFP growth.

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1 Several papers have identified this low level of quality of human capital (eg., Barro, 1999; Beyer, 2001).
2 Both Barro (1999) and Gallego and Loayza (2002) actually identify the quality of human capital as one of the dimensions in which Chile had the most opportunities to gain in terms of increasing growth rates.
To study in more details the mechanisms we use as a motivating theory the papers that suggest that "advanced" levels of human capital may be more relevant as countries approach the technology frontier (Acemoglu et al. 2006; Vandenbussche et al., 2006; Aghion et al., 2009). We argue that probably human capital quality is more related to advanced human capital than the quantity of human capital. As there is no evidence on this, we explore this hypothesis and find that, as expected, the quality of human capital becomes more important as determinant to growth as countries get closer to the technology frontier. Our results also imply that the effects seem to be entirely related to TFP growth. The policy implications of this result are very important for a country like Chile, which is now getting closer to the technology frontier.

Next, we present an analytical diagnostics to study how to affect several margins that may increase the quality of human capital. The production of human capital is a complex object because there are, among others, non trivial effects of out-of-school variables (eg. socio-economic status) on the human capital production function, dynamic complementarities, i.e., returns of investments depend upon previous and future investments (Cunha and Heckman, 2007; Cunha et al., 2010), non-trivial agency problems, and –given the relevance of the public sector in the provision and financing—government failures and political economy factors playing a significant role in potential reforms.

In this part of the paper we rely on our judgment and reading of the literature to suggest four lines of potential reform that may produce significant increases in human capital quality: (i) institutional reforms that redefine the number of policy instruments aimed at increasing human capital quality, (ii) a better connection between the pre-primary education sector and the primary and secondary sector, (iii) interventions that improve the working of input markets that are key for educational production (i.e., the teachers and principal markets), and (iv) reforms that improve the link between the educational sector and the labor market. Given that these are mainly conjectures based on our reading of the theoretical and empirical literature we think these suggestions, when possible, should be implemented initially in pilot programs evaluated using randomized control trials (RCTs).
2. Human Capital and Economic Growth

2.1 The previous literature

The cross-country and panel data empirical literature on the effects of the *quantity* of human capital on economic growth is voluminous. Most papers find a positive correlation of the average number of years of schooling of the population of a country and economic growth (Krueger and Lindahl 2001; Barro and Sala-i-Martin, 2004). However, it is unclear whether this effect is causal or not. For instance, Klenow and Bils (2000) present some evidence that the empirical patterns we observe are more consistent with reverse causality going from economic growth to human capital accumulation. Pritchett (2001) goes further to argue that the causal effect of years of schooling is essentially zero.

A key limitation of all studies in this area is that the identification of the effects is unclear and therefore one cannot rule out that the positive correlation masks reverse causality or omitted variables. A recent study by Aghion et al. (2009) tries to overcome this criticism by using plausibly exogenous political instruments for the quantity of higher education across the US states. This paper presents evidence of positive causal effects of higher education variables on income levels and growth at the state level operating mostly through productivity effects. The effects are not only statistically significant but also economically relevant. Unfortunately, the authors are unable to find credible instruments for primary and secondary schooling and, therefore, do not present evidence on causal effects of these variables on growth.

On the effects of the quality of human capital on economic growth, the literature is more recent since datasets with measures of the *quality* of education (using tests applied to students of several countries) are only recently available. In this dimension the datasets used in Barro (2001), Hanuskek and Kimko (2000) and more recently Hanushek and Woesmman (2008, 2009) are key for the study in this area. The inclusion of this

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3 One partial solution to this problem is the use of internal instruments (ie. lagged realizations of schooling) in the context of panel data models as in the estimates by Vandenbussche et al. (2006), Barro and Sala-i-Martin (2004), and Gallego and Loayza (2002). The problem with this approach is that if there is inertia in the factors that affect schooling—as suggested in several papers that relate schooling outcomes to history, eg. Becker and Woessmann (2009) and Gallego (2010)—then lagged realizations of schooling cannot be valid instruments and, therefore, these estimates are not causal. However, from an empirical point of view, the estimates that use GMM methods (as in Gallego and Loayza, 2002) pass the Sargan over-identification tests and, therefore, one have some confidence on the interval validity of the estimates.
variable in the analysis is relevant because it captures a dimension which seems to be important for the growth process: the efficiency or productivity of workers. Let us think of an extreme case in which students attend school many years but they receive no instruction or human capital at all, in this case the numbers of years students attend will have a zero effect on growth. As Pritchett (2001) argues bad quality schools may explain his finding of an absence of a positive effect on schooling on growth.

The papers by Barro (2001), Hanushek and Kimko (2000) and Hanushek and Woessmann (2008, 2010) present positive cross-country correlations of measures of the quality of human capital and economic growth considering different samples and methodologies. This correlation is actually much bigger than the one between the quantity of schooling and economic growth (especially after the quality of human capital is included in the regressions). Indeed, as in the case of the quantity of human capital, it is not clear whether the correlation reflects a causal effect or not. Hanushek and Kimko (2000) and Hanushek and Woessmann (2008) argue that reverse causality problems are not that relevant in this margin. They present evidence that there is a positive and statistically and economically relevant correlation between proxies of quality of human capital of the country of origin of immigrants and their wages in the US. Then, they argue that obvious concerns of reverse causality cannot explain the positive correlation they find. Still, it may be possible that some omitted variable explains the positive correlation. To deal with this problem, Hanushek and Woessmann (2009) present (i) some IV results using instruments related to institutional features of the education system and (ii) estimates using immigrants data in which they compare directly immigrants that were educated in the country of origin versus those that were educated in the US. All these results and checks seem to suggest that the quality of human capital has a positive causal effect on economic growth.

In terms of the mechanisms that explain the correlation, the literature is mostly silent with the exception of the paper by Jamison, Jamison, and Hanushek (2007) that present evidence suggesting that most of the effects come from effects of the quality of human capital on TFP growth. In addition, a recent study by Gennaioli, La Porta, Lopez-De_Silanes, and Shleifer (2013) also suggests that the impact of human capital on development operates mostly through productivity effects. They explore economic
development in more than 1500 subnational regions finding that regional education levels account for a large share of the variation in regional income. The direct influence is through education of the workers, entrepreneurs’ human capital, and externalities associated to the quality of human capital instead of the quantity. It is interesting that the second factor mostly affects development through the productivity of firms.

2.2 New estimates: quality/quantity of human capital and distance to the frontier

In this sub-section we present new evidence on the effects of human capital on economic growth. Our main contributions are two: (i) we estimate empirical models that extend the distance to the frontier hypothesis recently developed by Acemoglu et al. (2006) to the context of the study of the effects of quality and quantity of human capital on economic growth and (ii) we use a recently developed measure of human capital quality suggested by Schoellman (2012) to study in a better way the impact of this variable on economic growth.

On the theoretical side, recent research suggests the existence of interaction effects between distance to the technology frontier and the importance of factors leading to growth. The main idea is that economic growth and in particular (endogenous) technology improvements of a country come from adaptation and innovation activities (Acemoglu et al., 2006). These two technology activities use different factors as countries move closer to the technology frontier.

Vandenbussche et al., (2006) apply this idea to the impact of different types of education (advanced versus basic schooling) on economic growth for countries located at different distance to the frontier. They assume that adaptation is relatively (i) more intensive in basic education than innovation and (ii) more profitable when countries are far from the technology frontier. The result is that basic education has a bigger effect on growth for countries far from the frontier and advanced education has a bigger impact for countries closer to the technology frontier. Probably this result is also influenced by the fact that within the technology frontier adaptation involves efficiency gains through the reallocation of the same productive factors. Vandenbussche et al. (2006) present empirical evidence supporting that implication for OECD countries and, as previously mentioned, Aghion et al., 2009 present supporting evidence for this theory for US states.
They also present evidence that the effect of education on economic growth takes places mostly through technology improvements, as suggested by the motivating theory.

Our conjecture is that the differential effect of the quality/quantity of human capital on economic growth could be understood with the basic intuition of the models of distance to the frontier: it is likely that while the quantity of education is more related to the adaptation process, the quality of human capital is probably more related to the innovation process. If this conjecture is correct we should observe: (i) a bigger impact of the quantity of human capital on economic growth for countries located far from the technology frontier, (ii) a bigger impact of the quality of human capital on economic growth for countries located close to the technology frontier, and (iii) the impacts of human capital accumulation on economic growth being mostly related to productivity improvements than to resource accumulation.

The second contribution of this paper is related to the proxy of the quality of human capital we utilize in our empirical estimations. Most previous papers use internationally comparable test scores. This is a reasonable proxy for developed countries that have participated in several of the tests. However, as Hanushek and Woessmann (2008) argue, data for non-OECD countries are probably not as precise as for developed countries. In addition, internationally comparable test scores measure a proxy for quality just for the school-age population and are potentially subject to a lot of reverse-causality problems.

Recently Schoellman (2012) suggests using Mincerian returns to immigrants in the US as a proxy for human capital quality. This is a simple exercise that measures the marginal contribution of each additional year of schooling (i.e. the quantity of human capital) on wages and therefore is directly related to human capital quality. A particular contribution of the paper by Schoellman (2012) is the control for the potential bias arising from the fact that there may be selection of migrants to the US. Thus using this proxy we are able to both increase the number of countries with good information on human capital quality (and this allow us to include also poor countries that were not part of previous

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4 In the relevant regressions Schoellman (2012) controls for country of origin fixed effects and therefore is able to controls for all omitted variables that are constant across cohorts and that may affect both the returns to years of education and wages directly.
analyses) and to solve the above mentioned problem of reverse causality. Thus, we use this proxy variable as our main proxy for human capital quality.

Then, our main estimating equation is:

$$ g_i = \left(\alpha + \alpha_q q_i + \alpha_s s_i + \alpha_p p_i\right) y_{0i} + \beta_q q_i + \beta_s s_i + \beta_p p_i + \nu_i, $$

where $g$ is the growth rate of per-capita GDP (physical capital or TFP in some regressions) of country $i$, $q$ is our proxy for the quality of human capital, $s$ is our proxy for the quantity of human capital, $p$ is a proxy for institutions, $y_0$ is initial per–capita GDP (physical capital or distance to the TFP frontier in some regressions), and $\nu$ is an idiosyncratic error to country $i$.

We use data on GDP, physical capital, and TFP from Bernanke and Gurkaynak, 2002) and, therefore, include information ranging from 1960 to 1998 (and use values for 1960 as the initial relevant variables). As previously discussed, our proxy for the quality of human capital comes from Schoellman (2012) and corresponds to returns using the 2000 census and considering adult-age migrants working at least 30 hours in the US. Therefore, our proxy for human capital matches the age profile of adults working in the 1960-95 period. Our proxy for the quantity of human capital comes also from Bernanke and Gurkaynak (2002). Finally, our proxy for institutions corresponds to the variable called social infrastructure in Hall and Jones (1999). In terms of our proxy for distance to the frontier we consider the (log) difference between country $i$ TFP in 1960 and the maximum of TFP in 1960 (that corresponds to Switzerland).

We run regressions for TFP, per-capita physical capital, and per-capita GDP growth between 1960 and 1998 and present results in Tables 1, 2 and 3, respectively. Overall, results imply that that once we control for human capital quality, human capital quantity does not seem to have significant statistical effects on the variables of interest, mirroring results in the previous literature. In turn, human capital quality presents estimates that are mainly consistent with the distance to the frontier hypothesis: human capital quality affects much more TFP growth when countries are closer to the frontier (the opposite is true for human capital quantity, but the estimates are very imprecise).

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5 In order to simplify the interpretation of the coefficients we run the regressions with $q$, $p$, $y_0$, and $s$ measured as deviations from the mean of each variable. This implies that $a$, $b_q$, $b_p$, and $b_s$ are the effects for a country having the average value of each variable.
Interestingly, there is no evidence that human capital quality has any effect on the growth rate of physical capital per person.\(^6\)

In terms of the economic significance of the effects, there are interesting results. An increase in school quality (moving from the 25\(^{th}\) to the 75\(^{th}\) percentile of the distribution of this variable) is associated with an increase in annual TFP growth of about 0.8% when a country is at the technology frontier, but just 0.2% (and not statistically significant) when the distance of TFP to the frontier is 40%. Figure 3 presents the marginal effect of human capital quality on TFP growth conditional on distance to the frontier. As evident in the figure, Chile in 1960 had a TFP close to 40% of the frontier and in 2000 had a TFP equivalent to 55% of the frontier and therefore, the impact of human capital quality on TFP growth doubles from 0.2% to 0.4% and becomes statistically significant.

Additionally, our results imply that there exist strong complementarities between human capital quality and TFP levels. Figure 4 presents the estimated effects. Therefore, increases in TFP levels increase returns of investments in human capital quality and vice-versa. This suggests that the return of implementing (coordinated) packages of reforms that include both improvements in human capital quality and other reforms that increase productivity can be very high.\(^7\)

Finally, in terms of interpretation it is worth noting two relevant facts. First, while the effects are economically and statistically significant, the size of the effects does not imply that human capital is a *magic bullet* to get to the technology frontier and economic development. This relates to estimates in Hanushek and Woessman (2008) in which significant movements in human capital quality, say closing the 50% of the gap in human capital quality of Chile to OECD levels in 20 years, increases the level of per capita GDP by just about 15% by 2050, *ceteris paribus*. This is certainly a profitable project but will not by itself close the development gap of a country like Chile. Our estimates, in contrast, give a more optimistic flavor as we present evidence that if a country like Chile do other

\(^6\) There are other results that are interesting but we do not comment them in the main text given the focus of this paper: (i) there is a significant convergence effect in both physical capital and TFP, (ii) institutions present a consistently positive correlation with the three growth measures, (iii) there are interaction effects between institutions and initial conditions for GDP growth (mirroring results in Acemoglu et al. 2006).

\(^7\) These results also imply that there may be under-development traps in which due to strong complementarities some countries may end up having *both* low levels of TFP and human capital quality.
things to close the technology frontier, the returns to investing in human capital quality increase, but the highest effect on impact on TFP is just 0.8% (when human capital quality is very high and distance to the frontier is close to 0). As there is a strong convergence effect the medium and long run effects on TPF growth are much smaller.⁸

Second, as implicit in our previous calculations, reforms to increase human capital take time to produce positive effects as there need to be reforms to improve school quality today which will eventually produce effects on human capital quality of workers several decades after the reform is implemented. This obviously creates a number of political economy challenges to the implementation of reforms and also put a realism constraint on the discussion on human capital reforms.

In all, our results imply that human capital quality seems to be important to increase TFP and per-capita GDP growth in Chile today as the country is getting closer to the frontier. Hence, the type of skills required to improve production capabilities further are much more intensive in quality as the country starts to move from adaptation to innovation activities.

3. Determinants of Human Capital Quality

Given results in the previous section, the next question is how to improve human capital quality. In this section we discuss potential areas for reform in the case of the Chilean sector.

3.1 Some Stylized Facts⁹

We start presenting a number of stylized facts derived from (national and international) data available and that allow us to compare the current situation with other countries:

a. Relatively low results in internationally comparable test scores that have been improving over time

Most data available suggest that results of Chilean students in internationally comparable test scores are below the performance of most developed countries and that this low performance was also present in the 1970s (See Figure 5, Panel A). The most recent international data, however, suggest a process of convergence in test scores (See Figure 1,

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⁸ Obviously, there are other positive and normative reasons to improve human capital quality that go beyond maximizing economic growth.
⁹ We focus on stylized facts related to human capital “quality” and not on human capital “quantity”.
Panels B and C). In addition, the most recent national data also suggest statistically significant increases (for the first time) in test scores in several school levels, especially focused among students coming from low SES households, and especially in language tests (Figure 5, Panels D).

In a sense, the best way to summarize recent developments in Chile’s quality of education is looking at Figure 6 that indicates that between 2000 and 2009 the country not only increased its performance but also reduce the variation in achievements between students. Of course, it could be argued that the country started from a very low performance and that it was only a matter of time before starting to notice an increase in educational outcomes. Notwithstanding, the country’s educational system is showing a dynamism that cannot be underestimated.

b. Importance of family background in educational achievement is significant (mainly through segregation)

Results from international tests (like TIMSS and PISA) suggest that the percentage of the variance in test scores explained by family background in the Chilean case is high (Figure 6, Panel A). Interestingly when one decomposes this among (i) the variance of family background in Chile and (ii) the effect of family background on test outcomes (measured using the PISA Economic, Social and Cultural Status Index (ESCS), see OECD, 2011), results imply that (ii) is relatively low in the case of Chile in comparison to the mean OECD average (Figure 6, Panel B), even when one considers average PISA outcomes (Figure 6, Panel C). At the same time (i) is significantly higher then in the case of other countries (Figure 6, Panel D). Therefore, in the case of Chile it seems that the relevance of the ESCS is related to the fact that we are in front of an economy with a high level of inequality.

The previous result is amplified by the fact that ESCS segregation at the school level in the case of Chile is high. In fact, OECD (2011) reports that Chile is the country with the highest value for the share of the ESCS variance explained by variation between schools (hence, it shows the lowest level of social inclusion). Research suggests that this high level of segregation is mostly explained by self-selection at the household level and a high level of residential segregation (Gallego and Hernando, 2009). This leads to a
market equilibrium in which low SES students tend to attend low-performing schools. Interestingly, more recent research suggests that the self-selection problem is explained in a non-trivial part by the lack of information of poor families in terms of school outcomes (Gallego et al., 2013 using a randomized control trial; Allende and Gallego, 2013 using a Regression Discontinuity Design).

c. **There is a high variance of results between schools attending children of the same socioeconomic background**

Effective educational systems promote clear and ambitious standards that are shared across the different educational actors. However in the case of Chile, there is high variance of outcomes, particularly among low SES schools, between schools serving kids coming from the same SES background. Certainly, there is no single factor explaining these results but the fact that historically there has been almost no discussion about reasonable standards that every school requires to comply is something that needs to be remembered.

d. **There is a high variance of results within schools and among classes within schools**

A less noticed fact in the Chilean discussion is that there is a high degree of variance of student results within schools and even classrooms (Ramírez, 2007). If this were the only piece of information that an external observer had accessed to, she will not be impressed. After all, you could expect schools to have students of different abilities and social backgrounds. But as it was emphasized before, schools are not socially inclusive in Chile (indeed according to PISA they are not academically inclusive either), and therefore you would expect a lower variation within schools.

Taken together, these facts suggest that the market equilibrium we observe in the production of school quality has not been able to produce some minimum quality level for schools attending similar students. The equilibrium in education markets is obviously affected by both demand and supply characteristics but also by government regulations and interventions. In fact, the education markets in Chile
are probably better characterized as quasi-markets in which government intervention plays a key role (Gallego and Sapelli, 2008).

3.2 Human Capital Production: A Conceptual Framework

The production of human capital is a complex process. Human capital is a multifaceted good: it is multi-dimensional, subject to dynamic complementarities, produced with the family, peers, and others co-producers, and there is public provision and public financing. Given this situation the optimal policy probably considers at least the following two elements:

- It includes several instruments aiming at different margins.
- It integrates coordinated investments/policies at several stages of the life-cycle of the agents

One formalization of the process of human capital production is related to the following human capital production function (Cunha and Heckman, 2007):

\[ \theta_{t+1} = g_t(h, \theta_t, I_t), \]

where \( \theta_{t+1} \) is the stock of human capital at period \( t+1 \), \( g() \) is a function that may change in different periods, \( h \) is family background (or, more generally, non-school characteristics that do not change over time, as genetic characteristics, conditions or shocks during pregnancy, to a great extent socioeconomic and cultural background of the household, etc.), and \( I \) refers to investment. We could further define \( I = [I''] \) where \( I' \) refers to family (or more generically outside-school) investment and \( I'' \) refers to investment in schools (or more generically in human-capital creating institutions).

If we substitute this repeatedly starting from \( \theta_t \) we find that:

\[ \theta_{t+1} = g_t(h, \theta_t, I_t', ..., I_t', I_t', ..., I_t') \] for \( t=1, ..., T. \)

The current literature suggests the existence of the following effects:

- Family background matters: \( \frac{\partial \theta_{t+1}}{\partial h} > 0, \frac{\partial^2 \theta_{t+1}}{\partial h \partial \theta_t} > 0, \frac{\partial^2 \theta_{t+1}}{\partial I \partial h} > 0. \) This implies that families with “better” family background tend to produce, ceteris paribus, better human capital both statically and dynamically.
• Co-production: $\frac{\partial^2 \theta_{t+1}}{\partial I'_t \partial I^*_t} > 0$. This implies that investments in the family complement investments in the school and, therefore, families are co-producers of human capital.

• Self-productivity: $\frac{\partial \theta_{t+1}}{\partial \theta_t} > 0$. This implies that previous human-capital increases current human capital.

• Dynamic complementarities: $\frac{\partial^2 \theta_{t+1}}{\partial \theta_t \partial I_t} > 0$. This implies that the impact of investments on current human capital is increasing in the level of previous human capital, which in turn implies that if investments in initial periods where low (and, therefore, human capital is low), returns of future investments will be low). This is the idea of intertemporal complementarities.

• Critical stages. Self-productivity and dynamic-complementarities imply the existence of critical stages and, therefore, there are interventions that are key for future returns of human capital, in particular early-life investments.

3.3 Human capital production: A conceptual diagnostics of the case of Chile

The previous conceptual framework is interesting but still misses one key point in terms of public policy: Where do $I'_t, I^*_t,$ and $g()$ come from? They typically come from the outcomes of markets or quasi-markets with a bunch of (both market and government) failures and interventions aimed at different objectives. The formation of human capital through the educational system is a continuous process where every year is important and it is difficult to make exact distinction at each stage. But there are some insights from the literature that are useful to take into account. So, for analytical purposes we would

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10 It is worth emphasizing that all of these conclusions of the literature are stochastic (and not deterministic) findings and, therefore, the statements in the main text are not contradictory with some short-term interventions that are focused on poor students and improve significantly their educational outcomes. See a discussion on these programs in Banerjee and Duflo (2011) and Kremer et al. (2013) and evidence for Chile of one successful program in Cabezas et al. (2011).
consider two stages of the production of human capital from early childhood development to secondary education:\textsuperscript{11}

\textit{a. Early childhood development}

The pre-school system existing in Chile presents a multi-dimensional and unclear design: there are several (public and private) agents either providing directly or indirectly or financing child care centers. To some extent this is the result of the Labor Law that mandates firms with 20 or more women to pay for childcare between the age of 0 to 24 months (in fact between 6 and 24 months because there is paid maternity leave for six months). This service is provided by private paid institutions that work with companies in this age range and continue to offer the service for the next stages although the money comes then from the families. There is a very light supervision of these child care centers by the most important state provider of childcare (JUNJI), which is an institution that depends from the Ministry of Education. Firms also do some supervision. There are also private child care centers that do not work with private companies and offer the services with almost no supervision, except in matters unrelated to the child development. The exact number of children attending both types of child care centers is not very well known (some of them operate in both markets)\textsuperscript{12}.

The state provider has its own centers but also has agreements with municipalities, and not for profit NGO’s to provide childcare. In addition there is a private large independent NGO (INTEGRA) that gets all its money from government and depends from the First Lady (it also has agreements with external providers to support some of the child care centers). This system provides care and educational development for children between 0 to 6 years, although its focus is between 0 to 4 years since PK and Kinder are offered today mostly by Chilean schools, given the fact that the Chilean schools are financed through a voucher that includes PK and Kinder. JUNJI and INTEGRA are financed through a fixed amount of money defined each year in the National Budget. Table 4 presents the distribution of children between 0 and 6 years.

\textsuperscript{11} We will work only with a subset of all the relevant dimensions in each of the school system (and the relevant educational stages) and we will leave out from the analysis the higher education system.

\textsuperscript{12} Some very rough estimates could be obtained from household surveys.
It can be seen that the enrolment in PK and Kinder in both organizations is modest since as it was said these stages are covered mostly by schools. Both institutions, particularly the first, have shown some bias in the last years to concentrate its development in the range from 0 to 2 years, motivated by the fact that mothers working in firms with less than 20 females workers or in the informal sector do not get child care coverage. Of course, given the discrimination in coverage, it is understandable. However, this generates some tensions between the care and educational functions. It is true that they don’t need to be incompatible, but since most women in Chile work long shifts, the children stay for a long time at the child centers, which is expensive.

From a development point of view it seems that a couple of hours is enough. It is also unclear if the “institutionalization” of children requires to start so early from an educational point of view. As a result of these tensions coverage is lower than expected. In addition, there is no clear view about the standards that have to be asked from the different child care centers. Most of the supervision, which is weak and diffuse, if existent at all, is based on administrative and bureaucratic controls, related to infrastructure compliance, availability of educational materials, and personnel/teacher coefficients in each child center. The supervision is in the hands of JUNJI, which is also a provider. Conflicts of interest are evident. There is currently in Congress a bill that will change this situation and improve the institutional framework of the early childhood system but this is only a first step. Coverage has to be increase, particularly between 24 and 48 months of age and quality has to be assured. To move in this direction the objectives of early childhood education require clarification, more clear standards have to be defined and the compliance of them have to be professionally supervised.

b. School system

There is a (low-value) quasi-voucher system operating for the PK-12 education system. The voucher can be used in private and municipal schools. The financing of free private schools through a voucher is a long tradition in Chile. There is evidence

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13 This adjective requires a clarification. The relative annual expenditure per student in Chile is below the average expenditure per students among OECD countries when it is compared to the average income per capita, particularly in secondary education. See OECD (2012), Table B1.4.
that in the 19th century such scheme was already in place. It was legally established in 1920. However state schools were for the most part of the Chilean history financed differently, basically through an annual budget that was independent of the number of students attending each school. This dual system was changed in 1981. It was decided that all schools, state and private, were to be financed by a voucher per student of the same value. The voucher was independent of the socioeconomic background of the student. The same year, the state schools that were in the hands of the central government, were transferred to local governments. Since then, and only from the financing of schools’ point of view, only two major changes occurred. At the end of 1993 a contribution from parents to schools, on top of the voucher financed by the Government, was allowed. This contribution has a cap and a part of it is deducted from the voucher. Municipal schools were forbidden of seeking contribution from parents at the elementary level (although they operate with a very soft budget and get additional money from the local and central governments). This change was followed a couple of year later with a complimentary regulation that mandated schools charging a complementary fee to liberate at least a 15 per cent of the enrollment from such fees if there were vulnerable students. Of course, the capacity of the government to enforce this regulation has been modest.

The second major change occurred in 2008 when the government introduced a complementary voucher for the 40 per cent of the students, specifically the most vulnerable. The students receiving this complementary voucher are exempted of paying a fee whether they are attending or not a school that ask for a fee. Since then, most of the increases in the money for schools have been channeled through this complementary voucher. Currently it represents approximately 58 per cent of the regular voucher between PK and 6th grade (the elementary school takes eight year in Chile till 8th grade) and 39 per cent in the next stages. This complementary voucher comes with additional regulations to the use of the additional money.

This financing framework is complemented by specific educational policies, some of which include additional public monies although modest, aimed at: affecting both the extensive and intensive margins of the teacher markets, influencing the operation of schools, particularly the municipal schools, and the entry-exit of all schools, advising
schools on how to improve their performance; and providing a system of information based on scores obtained in national low-stake tests that are applied yearly in almost every school in different subjects and at least in two different grade levels. This multiple interventions produce a situation in which there is some lack of coherence in key components of the educational system (institutional weakness). Most of these interventions are based on a common underlying principle but are applied without coordination, and sometimes with contradictory objectives.

The differences between schools in performance and within them that were mentioned before tend to appear very early in the development of our students. So, at the age of 10, where the first national tests are taken, there are important variations in performance explained to a great extent by differences in socioeconomic background and they persist till the students leave the schooling system. In spite of the information collected through these tests that date back to 1995 there has been, in practice, little concern for the schools and the children with low achievements. Contrary to the norm in highly effective educational systems the picture in Chile shows an educational system without clear standards on what to expect about the performance of schools and students. This context will change in the next years since a new institutional framework is being installed in the country. A new institution, the Agency for Educational Quality, was created. It will be in charge of applying all the national tests but more important it will be a review office of the performance of schools. In order to do this task, it will propose standards that every school has to comply and will define a ranking for Chilean schools (of course there are controls for socioeconomic background of students attending each school) based on these standards. It will visit and review schools that are the bottom of the ranking more often. If schools are not able to satisfy the standards within a reasonable period they will lose the authorization to offer schooling services to students in Chile\textsuperscript{14}. This disposition is established by law and it is not a discretionary decision of the Agency. This institution is an educational review office that will visit schools and make recommendations to help

\textsuperscript{14} There are exceptions to this rule whenever there are no alternative schools for students. In this situation a provisional team take charge of the school.
them improve but each school is responsible of deciding changes. The reports issued by the Agency are public and therefore will be subject to open scrutiny.

The methodology for ordering the schools and the standards they have to meet are not defined unilaterally by this new Agency. They have to be approved by the National Council of Education, a national board with 10 members all of them with some educational expertise and that represent in an ample sense the Chilean society. A different institution, the Superintendencia de Educación Escolar, will assure transparency in the use of funds and that schools comply with the different aspects of the Chilean law. In this framework, the Ministry is in charge of guiding the whole educational sector specifically through the design of educational policies and the support to schools to help them deal with the new standards. This new institutional scheme is in its early stages of development. It aims to generate check and balances and specialization in terms of government intervention in education, but most important after its installation is completed there will be for the first time in Chilean educational history clear and reasonable standards for all educational actors involved in the provision of education. If there is some truth is the affirmation of education specialist that high performing education systems have, among their characteristics, clear and ambitious standards that are shared and met across the system, this institutional change may play an important role in the near future.

One of the dimensions carrying a lot of attention recently in the public debate is the teachers market. Chilean teachers are typically selected from low ability groups (the extensive margin) and monetary incentives for Chilean teachers are not well aligned (intensive margin). In turn, school principal role’s is totally undervalued.

This diagnostics suggests three general remarks that imply a number of policy implications that we develop in the following section:

i. It is quite clear that there is a de facto big difference of emphasis and instruments between pre-primary and primary-secondary education.

ii. There is a lack of coherence in some key components of the educational system (institutional weakness).

iii. It is unclear the coordination between the two initial levels: early education and the schooling system, which is key from a dynamic perspective.
3. Policy Suggestions

In this section we suggest a number of policies changes aimed at increasing the quality of human capital. There are two general principles that motivate our suggestions:

- Human capital policy should be consistent with other complementary reforms in other areas of policy, given the existence of complementarities among the quality of human capital and the productivity of the economy. Thus, suggestions in other chapters of this book that are aimed at improving the productivity of the economy are complements to the suggestions aimed at improving the level and quality of human capital.

- In general, there is no bullet proof suggestion and we are dealing with a complex object of study: then our advice is to do experimentation with policy reforms. Most of our suggestions below should be carefully evaluated before being scaled up. Since the Chilean educational system is very decentralized such evaluation shouldn’t be problematic. There are different instances where a random application of a specific treatment can be applied. Of course, there could be political complications in some cases, for example if an increase in salaries is considered, particularly in the municipal sector but since there is a large private subsidized sector this type of experiments can be managed with these organizations. But we don’t expect much problems and neither do we find it too complicated to perform such experiments. There are several examples around the world (see Banerjee and Duflo, 2011, Kremer et al, 2013 and the literature quoted therein). In fact, a series of the policies we suggest may be evaluated in a rigorous way.

3.1 Institutional reforms

We start suggesting our main institutional reform. As we argue before there are (probably) too many instruments trying to influence the behavior of the educational sector: some related to the supply side, some to the demand side. Some of them operate with contradictory logics and involve an enormous administrative burden on schools (indeed, the new institutional framework explained above if not appropriately installed may asphyxiate a lot of schools). Then, we suggest to simplify the set of
policy interventions and reallocate resources toward key margins and drop redundant instruments (eg., there are too many sources of school financing with different rationales) and add new ones (eg., insuring quality in the teachers market and improve the working of the pre-school market).

Specifically our suggestions in this line include:

- The definition of the value of the voucher consistent with some minimum quality and with SES background of students (in the beginning it could be a target to reach in a specific year). The key point here is that currently it is unclear where the value of the voucher comes from and this price creates a number of incentives and allocates resources in the market. In fact, in 1980 it was defined from the budget of that year divided by the number of students and augmented in an arbitrary amount. After the economic crisis of 1982-3 the voucher felt in real terms (25 per cent between 1981 and 1990). With the return to democracy in 1990 it began to rise but without a specific target. The complementary voucher introduced in 2008, although backed in some general studies, was also set at the end arbitrarily. Currently in Congress an additional complementary voucher is discussed. It is for the next 20 percent of students (remember that the first one in 2008 was for the 40 percent more vulnerable students). Although there is some empirical support for this new voucher it comes from the current equilibrium, already influenced by the different and contradictory incentives in place. Hence, it is a good moment to rethink about the design of the financing system of schools in Chile.

There are at least four factors that have to be considered in this design. First, the appropriate level of the voucher given a specific quality target. This will always require some narrow definition of quality, but the development of the standards propose by the new Agency and approved by the National Council of Education will serve as a guide. The value has to be consistent with the proposed changes in the teachers’ market (see below). The amount of the voucher will obviously differ for students with different socioeconomic and cultural backgrounds. But the design has to define the differential “prices” in
the voucher accordingly and in a better way that has been formulated until now.
A second aspect deals with the fact that currently the difference in value associated to a lower socioeconomic background is paid as a complement and there is a different set of rules than the ordinary voucher. Given the new institutional framework this idea doesn’t make much sense. Instead of having this additional voucher we proposed to have only one that has a different price for students of different backgrounds. The schools will be subject to the supervision of the general system of institutions. This idea is not incompatible with the fact that part of the money can be channeled to schools through other mechanisms. But this requires a good justification. In some countries with vouchers there has been an effort to distinguish between fixed and variable costs. The allocation through vouchers is used for the second type of costs and a direct allocation, independent of the number of students in a school, is decided for the first type of costs. Of course, it is not easy to distinguish clearly between both costs and such a policy may lead to inefficiencies (indeed some countries require a minimum number of students enrolled before they decide to allocate them governmental funds). We are open to such a distinction but based on thorough studies that justify this idea.
A third aspect to discuss in the design of the voucher is how to integrate it appropriately with the fact that families in Chile are allowed to supplement the voucher. There is an ongoing discussion in Chile where some educational experts are arguing for terminating this possibility. The main argument for moving in this direction is that the family contributions give rise to segregation. However, the evidence supporting this claim is weak, which is not incompatible with accepting, as we informed previously, that education is highly segregated in Chile. The segregation is very much influenced by the inequality of the country, the residential segregation and self-selection (see above). In addition, the decision to charge a complimentary fee is endogenous to the neighborhood where the school is located, the complementary voucher “works” as family contribution (schools are not allowed to charge those
students), and there are mandatory scholarships. The bill currently discussed in Congress and that creates a new complimentary voucher for the next 20 percent of students (the first was for the 40 percent more vulnerable) was left compatible with family contribution. Its prohibition seem too high a price to pay since it is only a 44 per cent of the complementary voucher for the students belonging to the 40 per cent of the most vulnerable households and the typical contribution for the middle income families is a small percentage of their incomes. Of course all of this is debatable. We don’t favor the elimination of the possibility that families contributing on top of the voucher but there are several ways to improve the integration between the vouchers and the family contributions in order to reduce the risk of segregation. As was said before, there is a “tax” established on family contributions that work as a deduction of the voucher. This tax however is very small. A better design of the deduction is required together with a complementary definition of the maximums amount each family can contribute related to the amount of the voucher (basic plus the complementary) that the government defines for each student is required. A related element regarding this issue is the prohibition for municipal schools to ask for family contribution at the elementary level. Do these schools have to be liberated from this restriction or alternatively compensated for this prohibition? Since they operate on very soft budgets the answer is unclear. But is something that have to be answered in the context of designing a renew voucher system.

The final element to be answered is if there is room, within the design of the voucher system, to have additional resources channeled for specific institutions. In Chile, for example, some people said that state schools have to get more money. Two lines of arguments are put forward. The first is basically normative. State schools, it is argued, are the only ones able to offer an education that is pluralistic, tolerant and lay. Hence, there has to be in the allocation of resource some preference for them. The second is more practical. It is argued, on the one hand, that private subsidized school are always able to select students in spite of what the law says while state schools are impeded of
acting in a similar way and, on the other hand, that state schools will sooner or later affected by a more strict legislation. They increase the cost for state schools to provide the educational service. Both claims, specially the second one, have some basis. But they are weak and from the perspective of the effectiveness and performance of the educational system we think that accepting these claims opens a Pandora Box that it is difficult to anticipate. To support with additional resources specific schools, both municipal and private subsidized, that show a special care for specific virtues -for example social inclusion, diversity, tolerance, among others-, is an avenue worth exploring but a preference for a subsector of schools is not something that we recommend.

- A key player in the current institutional setting corresponds to the agency to insure quality. This institution just started to work in 2012 and has three main roles: (i) to take and inform the national tests and propose quality standards, some of which will be based on these tests, that schools have to comply, (ii) to visit schools, review how they are complying with the standards and inform the educational community through a report of the results of its visits, and (iii) inform the closing of the schools that after a reasonable period are not able to improve and incapable of satisfying the standards defined (this is requested by law). In this institutional framework, the Ministry of Education has to assure that schools are able to get effective support to deal with the weaknesses detected during the visit of the Agency. These changes involve moving from very bureaucratic and administrative controls to a very professional with high stakes for schools. It is key to insure that this change works well and that, if required, complementary policies are put into effect. We propose therefore a transitory task force in charge of monitoring this process with an independent opinion, able to propose corrective measures if necessary. One important uncertainty in this new institutional scheme is the availability of good advice for schools. It contemplates the possibility of schools choosing the advice from private providers and a specialized division within the Ministry of Education itself. This is an aspect that need to be supervised appropriately.
The development of public policies aimed at particular key input markets since these are markets with important political economy problems. Below we developed a number of suggestions related to the teachers and principals markets.

The quantity and quality of information in the system has to be improved. On the one hand, the evaluation of schools has to move ideally to a value added model. Currently, it is based on a standardized test that doesn’t take into account children’s characteristics. Of course, value added tests are not exempted of criticism (see Baker et. al., 2010, for a good summary and Andrabi et al. 2011 for a recent application) and therefore there will be an intense debate if such a change is decided. We think there are good reasons to move in this direction and we recommend to implement a value added model for evaluating schools (a defense of this model and its usefulness are presented in Chetty et. al. 2011). Anyway, its implementation requires time since the country is lagging behind in the elaboration of a value added model. On the other hand, since in the short and medium run there will be no value added model available, there are some improvements that can be made within the current model. Particularly, the current situation can be explored to its full potential. For example, most parents are not informed that their daughters and sons are recipients of a complimentary voucher. Hence, some are deterred from choosing schools that charge a contribution from the family, although its complimentary voucher would be enough to cover that fee. Hence, the choice set of these parents, who are the most vulnerable, is artificially reduced. It doesn’t make much sense. Another restriction is that parents are not able to get the individual results of their children in the national tests. This is important in a country with an important variation in educational results between schools and with, it seems, a high grade inflation. Parents may believe that their children are doing well in their schools because they get outstanding grades but their performance in national tests could be very poor. If parents are able to check both results some uncomfortable questions for schools may follow which are welcomed. Of course, in the absence of value
added test some may believe that this information is of limited use but notwithstanding helps parents to be more aware of performance of the schools their children are attending. Therefore this information is still of value for parents. These are only two examples, but there is a lot that can be done to improve information for parents, and in general for the educational community.

Perhaps, the main proof of the low standards of the Chilean educational system and at the same time the insufficient expectations about what students can achieve is the experience of the Chilean secondary technical schools. Almost 44 per cent of the young people that graduate from secondary education in Chile do it from technical schools. The decision to pursue this alternative is made four years before graduation. Mainly vulnerable students choose it expecting that they will be ready for a job after graduation. Unfortunately, in most of these experiences, there is a strong disconnection between the demand of employer and the skills developed in these courses (Bassi et. al., 2012). Currently, a major transformation of the curriculum for technical schools is under way. The process included consultation to employers to define the most important subjects, but still there is a need for relevant reforms in this area. We propose to move to a decentralization of the curriculum with a more important participation of the productive sectors of each region in the definition of the areas that have to be taught in technical schools. At the same time we think there has to be at least an endorsement of those schools by employers association in order to avoid the teaching of irrelevant areas in each region. If schools do not find such an endorsement some doubt about the relevance will emerge. In these cases, it might be a better option to transform the school in a traditional one or eventually evaluate its continuity. An endorsement of productive sectors brings the Chilean technical schools closer to the tradition of the dual or vocational education that inspired them. Today, there are too far away from these experiences and are therefore, with some notable exceptions where there is precisely a close connection with companies or productive sectors, very ineffective schools. Of course, this approach can be complemented with studies of the demand for labor which are not easy to develop since data is not easily
available. However, these studies may avoid eventual conflicts of interest in the participation of productive firms.

3.2 Policies aimed at early childhood development.

Although there is controversy about impact of very early “institutionalized” care, particularly in the first 18 months of life (see for example Baker et. al. 2008), the existing evidence suggests that preschool could be a powerful tool to increase both cognitive and non cognitive skills. Hence, the still low coverage in Chile needs to be addressed, especially given the existing income inequality. For example it is less than 50 percent of children younger than five years old (and with a steep SES gradient). As was mentioned before, there are multiple providers and quality seems very heterogeneous probably as a consequence of the existence of weak institutions in charge of supervising preschool providers (one of which also have a role as providers). In terms of quality provision, current institutions do not have a clear focus. They are responsible for education in the 0-6 period but schools are gradually absorbing children from PK and Kinder. In this, schools are helped by the existence of the voucher (which is the tool to finance them), so that each child enrolled “comes with money under her arm”\textsuperscript{15}.

In turn, on the demand side of the market, there is little information on (i) returns to ECD and (ii) what is "good" in ECD. Thus, our main policy suggestions are:

- Clarify roles, separate provision and supervision of quality. In particular, the enforcement of standards and quality supervision. From an efficient and effective perspective it doesn’t make sense that the role of quality assurance is in the hands of the main state provider of childcare as it is the case today. A

\textsuperscript{15} In recent years the emphasis has been on the enrolment of children who are 0-2 years old. This has a lot to do with the fact that firms with 20 women or more in its payroll are legally bounded to support child care in this age range for them. But a lot of women work in smaller firms or in the informal sector (and even the size of the firms may be endogenously affected by the policies leaving some mothers without coverage). So this emphasis tries to correct the implicit discrimination in Chilean law. But it is clear that here the focus is on female labor participation and therefore, perhaps involuntarily, less attention has been put on the quality of the early childhood education.
specialized agency is better suited for this role. Given the recent changes in the institutional framework of the schooling system and the close connections between both subsystems it is reasonable that the role of quality assurance of the early childhood centers is transferred to the Agency of Education Quality. It needs to be remembered that this Agency has been recently created to review quality for PK to secondary education. An externality of this step is that it will increase the coordination between early and primary education.

- Define focus: our suggestion is to evaluate the separation of institutions that provide child care and early development of skills for 0-2 from an experience that is more educational for 3 and up\(^\text{16}\). Institutions that provide child care for kids who are 3 years old and up may be absorbed slowly by primary education (a phenomenon already observed in the fee-paying private schools).

- Another aspect that requires clarification is the use of early education as a care system to increase labor participation of women. This is a valuable objective, particularly given that it stands among the lowest in Latin America and among OECD countries (only Turkey has a lowest rate). From the empirical literature, already quoted, it seems that at this level a brief (let’s say four hour) educational experience is enough to produce the desired results in terms of cognitive and non-cognitive abilities. But not any program helps. It has to be an enriched experience which, among other things, requires very well prepared personnel. This is expensive and, of course, the cost of financing a long day program is much more that a four hour program. If the concern for women labor participation “wins” the risk is that to have manageable costs the quality of early childhood is below what is required to produce the desired changes in opportunities or that coverage remain low. A better alternative is to distinguish more clearly between both objectives and act in accordance with them (For example the personnel in the morning may be different from the afternoon in the preschool centers).

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\(^{16}\) We understand that there is a lot of debate on this issue and we are simplifying the separation, but given some international experience it makes sense, at least from the point of view of organization of the sector.
The existence of multiple providers and regimes, and also the way resources are allocated have led to an arrangement where expenditures for child differs enormously. So there are children that get more than 100 per cent more money than others for theoretically the same early education. The heterogeneity of the system has a lot to do with this unfair distribution of the resources. Given the experience that Chile has had for more than 30 years with vouchers it seems reasonable to extend this financing scheme to early education (remember it is already in place for PK and K with some restrictions for the first of these levels). We have said earlier than a better design of the voucher system for schools was required. That impulse may be used for designing the voucher for early education. It will help the advance to a fairly treatment of each child and refine the allocation of resources to satisfy different objectives in the first year of life of the children. In addition, it will be an incentive to increase coverage which seems appropriate if all the other reforms we are proposing are in place.

Some clarification is required about the organization of the state providers. As said before, one is a state organization (JUNJI) and the other is a private ONG (INTEGRA), but for most purposes it is also a state organization (the main difference is that their employees are hired under private law while employees in JUNJI have a public officer status). Both institutions have collaboration with municipalities and private ONG that supply early childhood education under specific agreements. If a voucher system is introduced these collaborators will get the money directly through the voucher administrator (a division of the Ministry of Education) and the supervision will be in charge of the new institutions: Agency and Superintendencia. Both institutions will remain only as providers. To have two important centralized providers is strange. One possibility is to transfer the early childhood centers in the hands of both organizations to the state providers of education. Currently they are the municipalities, but there is an ongoing debate if they are the appropriate institutions to be in charge of education. An alternative organization that is being proposed is a local agency of education (an independent and
professional body with a board). However, no matter how this debate is resolved, this alternative is a possibility. A different way is to keep a centralized provider, evaluating a merger of JUNJI and INTEGRA, and organized the new institution much more professionally with a board that is responsible for the day to day management and development of the institution, and is at the same time accountable to the Chilean authorities.

- Finally, it is surprising how little is known about the early childhood system. For example, there is no information about the costs of educating children in the different programs. There are no clear goals for these programs and there is a lack of basic measures of performance. Hence, it is indispensable to increase the amount, pertinence and quality of information available. This policy is relevant in itself and also as a way of increasing accountability through parent supervision.

3.3 Primary and Secondary School Markets

As it is evident from the conclusions of the theoretical framework, while ECD is important for increasing returns of future levels of education, it is also true that investments in preschool education will have a larger return if they are met with “good” schools. In these markets there are many margins in which to intervene, but here we want to mention two that are central and there maybe some room to implement serious reforms. These are teachers and principal markets. The education production function is intensive in human capital, and teachers and principal account for more of the expenditures. Directly or indirectly, governments act as a monopsony in the buying of these educational “inputs”. Therefore, their actions and policies are fundamental for the clearing of both markets. Moreover, there are two subsectors that receive the voucher. On the one hand, the state owned schools which are in charge of the local governments. Here, salaries are basically defined by a national statute for teachers employed by local governments. Principals are not able to influence their definition. Salaries increase automatically in the state sector with age. In some

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17 The exact form these institutions could take, both geographically and from an organizational point of view, is unclear. We don’t discuss this issue in the paper because we are skeptical about the real impact such a transformation could have on educational quality. We think, as suggested below, that independent of how the provider of state education is organized the key aspect, given the changes in the institutional framework that is taking place in Chile, is to assure more autonomy to state schools.
municipalities the local authorities define some bonuses associated to performance and mostly to children attendance (the voucher is paid against attendance and not enrolment) that it is paid with extra resources. Principals face a lot of restrictions in the process of hiring and firing teachers, although a very restricted flexibility has been introduced in this process in the last two years. Anyway, the firing of teachers is very difficult. On the other hand, the private subsidized sector face fewer restrictions. There is a minimum salary and some mandatory assignments that have to be paid to the teachers working in the private subsidized sector. But it is not mandatory to increase salaries with age. In addition, the teachers working in these schools do not have a special protection and work under the conditions defined by the private law. Hence firing is easier. Of course, the state sector works as a kind of benchmark for defining salaries but the private sector doesn’t need to keep teachers that don’t perform well. Indeed, teachers in the private subsidized sector are younger than in the state sector. This fact allows the private subsidized sector to pay their younger teachers more than in the municipal sector (these data come from the Encuesta Longitudinal Docente 2009). A similar analysis can be applied to the principals market. Hence these markets are far from being “pure” and face a lot of interventions and restrictions in their development. These facts have to be taken into account when considering any policy proposals. Some additional considerations are offered below.

i. **Teachers market**

Current available evidence suggests that school quality is highly correlated with teacher quality. Unfortunately it is unclear how to insure a high quality teaching force (especially because teacher quality is not that related to observable characteristics of teachers) but in the case of Chile it is quite clear that ability plays an important role (as measured very imperfectly by SAT or PSU scores). Teachers in Chile come heavily from the percentiles 33 to 60 in the distribution of PSU scores (with test scores concentrated between 450 and 525 points). This is a consequence of market conditions and lack of social recognition for teachers (probably a by-product of both previous facts: the teaching profession is non selective and market conditions of the teacher market). Then, new teachers are not coming precisely from the high ability
groups. It is difficult to change this situation without improvements in working conditions: salaries among them.

In particular, regarding teacher salaries, wages are low and decrease relatively to other college graduates through time (See Figure 8). This happen because salaries of alternative disciplines grow fast in Chile with experience while salaries of teacher grow slow. Moreover, the lower bound of wages (which we proxy using the wages of the 10th percentile of the distribution of wages) is in relative terms not that bad and therefore one may think that for a low ability type is easier to choose the teaching profession respect to a high ability type. Therefore, the underlying incentives explain the important increase in teaching programs and enrolment.

We are aware that increases in salaries, especially if they are considered in isolation, are in general not an effective policy (Hanushek and Rivkin., 2006). Variance in salaries is the key but education is a highly unionized sector and the political economy of the reforms in education makes it difficult to achieve reasonable degrees of salary dispersions.18 But the question remains of how is it possible to attract and retain high ability people without a reasonable compensation? It is important to take into consideration that returns to higher education in Chile are particularly high if compared with most OECD countries. (see Education at a Glance 2012, table A8.1, age range 25-64). The same figure for Chile shows a 167 per cent difference (based on CASEN 2011)19. Moreover, the variance in college graduate salaries is enormous and highly correlated with the selectivity of programs (as measured by college entrance exams). Hence, the opportunity cost for high ability people of choosing the teaching profession is very high. Probably these are the relevant figures for attracting new teachers in the margin and in the future (today there are a lot of them who do not have higher education).

In this market, to a great extent government defines wages for teachers through negotiations with the only teachers union for the public sector (municipal sector). It is

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18 One point in which Chile is unusual is that only a fraction of the enrollment (ie. students in public schools) is subject to heavy regulations and a strong unionism. However, private educational providers observe a similar behavior in their salary schemes. Notwithstanding when pressured they react by differentiating salaries.

19 If you consider only university degrees which probably is a better reference group for teachers since they required a university degree the difference is 264 per cent.
a complex process (e.g., currently there are 18 different allowances for defining teachers compensation) but at the end teachers wages rely heavily on experience. Although, the private subsidized sector requires meeting only some of the conditions agreed in those negotiations (minimum wage among others), it uses them as a benchmark. Moreover, they are constrained by the voucher, which accommodates imperfectly the negotiations recently described, and in some cases they count on additional resources from parents. However, they manage costs by controlling the age of the teachers, an option that is not open to public schools which face a rigid statute with heavy restrictions for dismissal.

We suggest that to surpass this problem one possibility is to let the government define salaries only for the most able teachers. In Chile there is a teacher evaluation program that classifies teachers in four categories (unsatisfactory, basic, competent and outstanding). The last ones are very few and they can get an extra reward only after getting good qualifications in an exam administered by the central government. The first category is also small.

This salary schedule may follow market conditions for college graduates that may be a relevant reference group for high-quality prospective teachers. A lower bound may be part of this definition but other allowances should be eliminated. School owners (sostenedores) will decide who are their outstanding teachers and probably through decentralized negotiations will define salaries for other groups of teachers. Our sense is that this scheme has a better chance to resist the political economy of the educational sector in Chile that alternative overall reforms and, as importantly, is aimed at the relevant extensive margin of the teachers market in Chile: increase the number of high quality prospective students entering the teaching profession.

Other policy options that are reflected in the current discussion of a new teachers’ law and that should be reinforced are:

- The installation of new barriers of entry accompanied by higher salaries.
  We know that new requirements for teachers do not necessarily affect their quality (see for example Angrist and Guryan, 2008), particularly if they are implemented as isolated measures. But, there is evidence that a broad set of measures summarizing cognitive and non-cognitive skills can
work as a moderately large and statistically significant predictor of teachers’ capabilities as measured by students’ outcomes (Rockoff et. al. 2011). Moreover, if there is some kind of provisory hiring for the two first years the possibility of screening the best teachers increases significantly. Chile has been experimenting with a screening test, but it is too modest in the abilities that it captures. A better design of the test along the ideas described here is worth pursuing.

- An extensive program of merit pay. Although controversial, merit pay seem to work in different cases (see evidence in Kremer et al., 2013). There are of course difficulties of linking it with children’s learning. But it can influence behavior that directly or indirectly may help educational achievement of students. Chile has been experiencing with merit pay, but they are too far away from daily teaching. Thus, this is an opportunity for new emphasis.

- Steps have to be taken to inform principals better about the teachers performance, even if the information is not used to pay for merit. The provision of objective measures of teachers’ performance helps principal to take appropriate decisions. So, employer learning increases turnover for teachers with low performance and produces test score improvements (Rockoff et. al. 2012). In an educational system with low performance and lack of standards like the Chilean one it seems important to move in this direction. Chile has been experiencing for a long time with teacher evaluation and can move to more sophisticated levels of information. Particularly, if the country goes to a value added model as explained before, valuable information can be produced for principals. Currently they are getting more detailed information about the performance of their teachers in the national evaluation. Specially, on the different aspects that are evaluated in the portfolio they have to submit to this evaluation program. The portfolio includes a recorded class. But this evaluation is relevant only for teachers that work in the state sector and is the consequence of the existent restrictions to their hiring and firing.
ii. Public School Principals

Students tend to perform better in schools that have autonomy, especially if there is accountability (Woessmann, 2003). Chile is going to have a much more strict accountability system in the near future as schools will have to satisfy educational standards and if not they will have to close. This tendency to be productive needs to be accompanied of higher levels of autonomy (especially at public schools). Currently, principals have almost no autonomy and to a great extent they face restrictions not seen in other countries for deciding about day-to-day matters. In addition, municipalities (the “owners” of public schools), in spite of some changes in the regulation, have too little influence in the nomination of principals.

This is a vicious circle that needs to be fixed: “We don’t trust principals. Hence we put them restrictions that limit their autonomy and they are not subject to evaluation because we also don’t trust local authorities in charge of educations.” Therefore, the educational system is characterized by an inertia that is not good for the production of human capital quality.

We think the new system of quality assurance that is being implemented in Chile is an opportunity to break this vicious circle. It should be much easier and less risky to move for increasing school’s and principal autonomy in their day-to-day management of the schools and in selecting their team. In fact, most good performing public schools should be rewarded with this autonomy. Such a policy will also increase the incentives for low performance schools to improve their achievements.

These changes need to be accompanied by improvements in the process of selecting the principals. Since the system of quality assurance put emphasis on school achievements the principal performance will be relatively easy to evaluate. In addition, to comply with this idea, the teachers’ statute have to be reformed. This is a challenging task but our view is that the teachers union is weak and has lost support in the population.20

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20 Branch et al. (2012) provide evidence exactly along the lines of the suggestions in this sub-section. They find positive effects of school principals on student outcomes and argue that these effects seem to operate through the management of the teacher force.
4. Conclusions

This paper takes a relatively optimistic view on the role of education and the production of human capital as a factor to increase the productivity and growth performance of Chile. It is optimistic because we present evidence that human capital quality is important for growth and is probably be more important as Chile gets closer to the technology frontier (as it is the case now). We are also optimistic because we identify some key areas of reform that we think are doable and could yield significant improvements in human capital quality even in the short- and medium-run. However, it is just moderately optimistic because our reading of the evidence is that human capital quality matters but the size of the effects are not of an order of magnitude that will guarantee that Chile become a developed country just by increase it. Putting it differently, human capital quality is not a panacea for the Chilean growth prospects. Moreover, our evidence also suggests that the impacts of human capital quality on growth depend positively upon other reforms that may increase the productivity of the economy.

On how to increase human capital, we think there is room for reform especially in four areas of reform affecting different margins of the human capital quality production process: (i) institutional reforms to simplify regulations and align different policy instruments; (ii) the development of institutions and policies to increase the quantity and quality of the provision of early childhood development and to coordinate this system with the posterior processes of education; (iii) simple reforms affecting the teachers market and, in particular, the ability of the system to affect the extensive margin by increasing the number of high ability students that go to the teaching profession, and (iv) reforms aiming at giving more autonomy to schools and principals in public schools and improving the selection process of them.

A final comment on the suggested reforms. As we discussed above we think an agenda of reform in the education system needs that most components to be evaluated from an ex-ante perspective. The education sector in Chile—and in other countries—is full of grand proposals or explanations without empirical evidence. Take the recent discontinuous increase of tests scores in Chile since the 2010 round of the SIMCE test, especially among the poorer students. Explanations given to this increase range from short-run policy changes implemented by different governments to explanations related
to increases in pre-school enrollment, in the value of the voucher to poor students, in the number of hours taught in Chile since a major reform implemented since the late 1990s, and in the years of education of mothers. Do we know whether these explanations are plausible? Yes, for all of them one could find some supporting empirical correlations or even causal evidence for other countries. Do we know whether they mattered for Chile? Unfortunately no. All these policies lacked a serious evaluation to identify their causal effects of school quality. Why? Because most of them were implemented at once in most of the system without really knowing whether they were going to work or not. A humbler approach is to try to prove the reforms (when possible) in a pilot of for a subset of the educational system, learn whether they work as intended or not and whether they have the expected impacts and next if they work, move to implement the reforms in the complete educational sector or in the areas in which the reformed worked as expected. This certainly applies to a number of the reforms we suggest in this paper.
References

Acemoglu, D. P. Aghion, and F. Zilibotti (2006) "Distance to Frontier, Selection, and Economic Growth"


Bitrán, E. y C. González (2010) “Productividad Total de Factores, Crecimiento e Innovación”, Documento de Referencia, CNIC.


Figure 1: Human Capital Quantity and Income

Figure 2: Human Capital Quality and Income
Figure 3: Marginal Effects of Human Capital Quality on TFP Growth

Figure 4: Marginal Effects of the Interaction of Human Capital Quality and Distance to the Frontier on TFP Growth
Figure 5: Human Capital Quality in Chile, several time periods

Panel A: Science Tests and per-capita GDP, 1970 (log-log relationship; 14 years old students)

Panel B: International Test Scores, 2000-2010

Panel C: Science PISA Test Scores and per-capita GDP, 2009 (log-log relationship)

Panel D: Leaning gap, several years, Ratio of learning for 90/10 percentiles, by year of birth and grade

Source: Hanushek and Woessman (2008) and Penn World Tables.

Source: Contreras and Gallego (2013)

Source: OECD PISA dataset and Penn World Tables.

Source: MINEDUC (2013)
Figure 6: Change in Performance, 2000-2009, PISA test

Source: OECD PISA 2009 database, Tables V.2.1 and V.4.1
Figure 7: Socioeconomic Status and Education Outcomes

Panel A: Percentage of Variance in Performance explained by the Variance of Economic, Social and Cultural Status

Source: OECD (2011)

Panel B: Effect of the Economic, Social and Cultural Status Index on PISA Test Scores

Source: OECD (2011)

Panel C: Effect of the Economic, Social and Cultural Status Index on PISA Test Scores, controlling for PISA test scores

Source: Authors’ elaboration using OECD (2011) data

Panel D: Variance of the Economic, Social and Cultural Status Index and PISA Test Scores

Source: Authors’ elaboration using OECD (2011) data
Figure 8: Average Teacher Salary as a Percentage of Other University Graduates

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Table 3

Dependent variable: Income per Capita Growth 1960 – 1998

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<td>(0.048)</td>
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Table 4
Enrolment in preschool education in JUNJI and INTEGRA: 2012

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<th>Day Care</th>
<th>PK</th>
<th>Kinder</th>
<th>Total</th>
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<td>2.202</td>
<td>177.199</td>
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<td>Integra</td>
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<td>43.243</td>
<td>8.772</td>
<td>1.107</td>
<td>68.866</td>
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</table>
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Matta, Juan José: “EL EFECTO DEL VOTO OBLIGATORIO SOBRE LAS POLÍTICAS REDISTRIBUTIVAS: TEORÍA Y EVIDENCIA PARA UN CORTE TRANSVERSAL DE PAÍSES”. ECONOMIC HISTORY AND CLIOMETRICS LAB WORKING PAPER #3, 2009


